U.S. POWER GENERATION TECHNOLOGIES

A PROMISING FUTURE FOR U.S. EXPORTS

by the Energy Division,
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Power generation capacity is one of the most prominent issues currently facing the energy sector. Countries across the world are assessing their power generation needs in light of greater anticipated demand for electricity in the decades ahead. In the Bush Administration's National Energy Policy, an entire chapter is dedicated to international energy relationships and the importance of energy diversification and security. These factors point to several exciting opportunities for U.S. companies in the power generation field.

The United States is a world leader in power generation technology and infrastructure. With global demand for electricity expected to double over the next 15 years, U.S. companies are poised to take advantage of opportunities to provide the means of generating electricity to over two billion people — as well as to contribute to the fuel supply necessary to power such systems. Current estimates predict that over the next 10 years, this international market will offer four times the growth potential of the U.S. domestic market.

INCREASING GLOBAL ELECTRICITY DEMAND

According to the International Energy Agency (IEA), overall global energy use is expected to increase by about 2 percent per year through 2020. The bulk of this projected increase in world energy demand will come from developing countries as a result of rapid economic growth and industrial expansion, significant rates of population increase and urbanization and the substitution of commercial for non-commercial fuels.

World electricity generation is itself projected to increase an average 2.7 percent per year through 2020. As a result, as much as 3,000 gigawatts of new generating capacity are expected to be installed worldwide to accommodate this surge in demand. This new capacity is valued at approximately $3 trillion. The world's developing countries will need to invest approximately $1.7 trillion in this new generating capacity, which presents enormous potential for U.S. exports. Most of the demand is expected to be met with combustion turbines in industrialized nations and coal in developing nations.

In the energy sector, it is important to keep in mind that there is an established relationship between economic activity and energy demand. With increasing economic activity comes greater energy demand, whereas in times of economic slowdown, this energy demand declines. Deviations from projected economic growth paths have a fairly predictable impact on energy demand; the correlation between economic trends and energy demand has been observed numerous times throughout the world.

BEST EXPORT PROSPECTS FOR U.S. COMPANIES

Providers of U.S. energy equipment and services enjoy an excellent international reputation for quality and service. As a result, U.S. exports of energy-related equipment and fuel increased by 42 percent since 1996. This positive export trend is expected to continue into the foreseeable future, due in part to liberalized and deregulated electricity markets, as well as some expected regional power generation capacity shortages. U.S. power generation technology manufacturers will compete primarily with European and

Japanese industry to sell their reliable and environmentally friendly electric power technology to both developing and industrialized nations.

U.S. CLEAN COAL TECHNOLOGIES

Coal is one of the world's most abundant fuel sources. It is expected to remain a primary fuel source for electricity production despite a projected slight decrease from 34 percent to 31 percent of the world's total energy mix. New technologies are able to pre-treat and burn coal much more efficiently than in the past. These technologies reduce emissions of sulfur and nitrogen oxides, while providing distinct advantages over conventional coal utilization systems. In new coal-fired power generation plants, clean coal technologies can be used to reduce emissions to acceptable environmental limits as well as to provide greater generating efficiencies. The best markets for these U.S. technologies exist in coal-dependent countries such as China, Eastern Europe and India.

NATURAL GAS TURBINES AND COMBINED CYCLE POWER GENERATION

Natural gas accounted for 19 percent of total world electricity output in 1999, largely because of its abundant supply, competitive cost and low output of harmful emissions. It is expected that this average will jump to about 26 percent by 2020. Given the considerable U.S. experience in using natural gas for power generation and heat, it is natural that U.S. companies have a competitive advantage in foreign markets. The U.S. has been the largest consumer of this technology in recent years due to the increasing use of natural gas for new and planned power generation plants. It is predicted to maintain this status for the foreseeable future, with Asia and Australia being the best prospects for exports of this technology. However, a current two-year manufacturing turnaround on some larger turbine units may slightly impact potential U.S. domestic and export sales.

NUCLEAR ENERGY

This industry has achieved a second straight year of record power generation levels. In addition, there has been an increase in public awareness about some of the positive environmental aspects of nuclear power: it does not produce some of the harmful emissions that are associated with coal and gas power plants, such as nitrogen oxides, sulfur dioxide, mercury and carbon dioxide. U.S. nuclear electricity generation has increased in recent years because of new technologies, standardized plant designs and an improved licensing process.

The U.S. nuclear industry faces several challenges in the international market. Competitors frequently enjoy government subsidies and other "soft" assistance that are not available to U.S. companies. Many of the most promising short- and medium-term markets have non-tariff trade barriers that hinder U.S. industry. Despite these difficulties, there are possible market opportunities in China, Eastern Europe, Japan, South Korea, Taiwan and Vietnam. The combined value of these markets is estimated to exceed $100 billion.

DISTRIBUTED POWER GENERATION TECHNOLOGIES

Microturbines

Microturbines are the diminutive cousin of traditional turbines. Their only moving part is a compressor-cum-rotor, thus making them relatively easy to operate and maintain. Because of these properties, some electrical industry analysts believe that microturbines could eventually revolutionize the power industry. Producing from 25 to several hundred kilowatts (KW) of power, microturbines ideally serve small retail establishments and entities in need of flexible power generation options.

Diesel and Turbine Internal Combustion Engines

Small diesel and turbine internal combustion engines form a large part of the approximate $5 billion annual worldwide market for distributed power generation technologies. Their ability to provide power immediately, as well as their small size, has made them highly desirable in geographic areas that have minimal electricity transmission infrastructure. Given the growing electricity demand around the world and concerns about adequate power generation capacity in many countries, these small engines are increasingly providing power for commercial users. These users purchase them to ensure a reliable supply of electricity for their business operations and to lessen their dependency on high cost peak-time electricity. The Electric Power Research Institute (EPRI) estimates that by 2010, the world market for these technologies will average about $30 billion annually. U.S.-based Caterpillar, Cummins Engine, Ingersoll-Rand and General Electric are among the U.S. companies increasing their product offerings in this market.

SOLAR POWER AND WIND ENERGY TECHNOLOGY

Exports of U.S. solar photovoltaic (PV) cells and panels and wind energy equipment and services, have continued the 1990s decade-long trend of rapid growth. Accelerated export market growth, especially in Europe and Japan, is expected to continue in 2002. European and Japanese government and power utility policies that dramatically increase the amount of electricity generated by environmentally sustainable energy sources and technologies have stimulated this export market growth. Because renewable energy technologies can generate electricity at the micro-level (e.g., enough for an individual home), these are an attractive alternative for dispersed and remotely

located populations. There are many small and medium-sized businesses in the renewable energy technologies sector that are well positioned to compete in the international marketplace.

Solar Power

In most European countries and Japan, growth in solar PV sales and installations is attributed to the rapid expansion of building — integrated solar PV in commercial and residential buildings. Solar PV systems installed on top of or near buildings, or in the buildings' skylights and windows, are integrated into the buildings' power connections with the utility grid. Thus the solar PV panels can either generate power for use in those buildings (instead of power received from the grid), or can be transmitted directly into the utility grid under "net metering" procedures. Under net metering, accumulated power usage recorded by the building's meter is decreased by the solar power fed into the grid, thereby reducing monthly power bills. In Japan alone, approximately 100 MW of solar PV panels were installed in buildings in 2000, a large quantity that, for comparison sake, equals almost one-eighth of all solar PV panels installed worldwide during the past 20 years.

Export sales of U.S.-manufactured solar PV cells and panels increased by almost 80 percent from 1994 to 1999. U.S. solar PV cell and panel exports grew even faster in 2000, increasing by almost 38 percent from 1999 levels to reach $185 million. Since the value of solar PV cells and panels is almost one-half of the total system cost, exports of all solar PV systems and equipment in 2000 is estimated at $350 million. U.S.-produced solar cells and panels comprise approximately one-quarter of total global shipments. In 2000, sales to European countries accounted for 48 percent of total U.S. solar PV exports, while sales to Japan were 21 percent of total exports.

Wind Power

U.S. exports of wind power equipment and services also accelerated in 2000, with the majority of sales concentrated in European countries and in India. Measured by megawatts of wind power installed, the world market increased by almost 32 percent (4,500 MW) in 2000 to a total level of 18,500 MW installed around the globe. Almost 75 percent of that total wind power is installed in European countries, with Germany's total of 6,400 MW reached in 2000; Spain's total reaching 2,600 MW; and Denmark's total reaching 2,300 MW. By comparison, domestically-installed wind power in 2000 increased by over 40 percent from 1999, reaching a total level of 2,500 MW installed.

The rapid growth of wind turbine production, installation and operation is expected to continue during the next five years. Over 39,000 additional MW of wind power is expected to be installed worldwide between 2001 to 2005, the vast majority which is likely to be installed in Europe, Japan and a handful of developing countries such as India, Brazil and China. It is estimated that between 2001 and 2005, worldwide installation of this additional wind power generation and conditioning equipment (and associated services) could reach $30 billion.

WHAT'S NEXT? FUTURE POWER GENERATION TECHNOLOGY EXPORTS

Fuel Cells

Fuel cells are electrochemical devices that convert a fuel's energy directly to electrical energy. In turbine-generated electrical power plants, a fuel (coal, oil or gas) is burned at a high temperature to produce a pressurized steam that turns the blades of the turbine to generate electricity. This method of producing electricity is mechanical. Fuel cells do not require a combustion fuel to be used to convert heat energy to mechanical energy and finally turning mechanical energy into electricity. Instead, fuel cells chemically combine the molecules of a fuel and oxidizer without burning, thereby dispensing

THE ENERGY DIVISION

The Energy Division is part of the Trade Development program in the International Trade Administration (ITA). Trade Development is the only organization in the federal government that analyzes foreign markets from a U.S. industry sector perspective.

Specifically, Energy Division international trade specialists monitor trade policy issues and develop interagency strategies to remove foreign trade barriers; lead bilateral commercial energy working group activities with key foreign nations to increase U.S. export competitiveness; and offer trade promotion services such as trade missions, conferences, and trade shows to expand U.S. market share abroad.

In addition to covering the area of power generation, the Energy Division's international trade specialists track sectors such as oil and gas, coal, nuclear, and renewable energy. The Energy Division is also responsible for the Industry Sector Advisory Committee (ISAC) on Energy. The ISAC is comprised of representatives from U.S. energy industry associations and businesses that have experience and interest in the international marketplace. These ISAC members serve as advisors to the U.S. Government on energy-related international trade policy matters. For more information about the ISAC on Energy, or to learn how to become a member, please contact Samuel Beatty at (202) 482-4179.

The Energy Division stands ready to assist your company in its export activities. For additional information, please contact us at (202) 482-1466.